DSEControl®

DSEM640

PROGRAMMABLE CONTROLLER FOR USE IN VEHICLES AND OFF-HIGHWAY MACHINERY



KEY FEATURES / SUMMARY

- Controller specifically designed for mobile applications
- Powerful 32 bit processor with 220 MHz clock speed
- 4 MB application memory
- 32 configurable inputs, digital and analogue capability
- 36 configurable outputs with digital, PWM and PWMi
- 4 independent CAN interfaces, J1939, CAN Open and Raw CAN
- Ethernet interface for communication
- Flexible user programming via CODESYS 3.5 (C programming on request)
- Ruggedised die cast aluminium housing for IP67 protection

ADDITIONAL HARDWARE	DSE PART
M64x Connector Set x3	007-035
M64x Connector Harness Set x3	007-036
M12 to Ethernet Cable	016-160
M12 to USB Data Cable	016-161

OVERVIEW

DC SUPPLY
8 V DC to 36 V DC

CURRENT CONSUMPTION
OPERATING CURRENT
< 300 mA at 24 V without external loads

TOTAL INPUTS/OUTPUTS
68 (32 inputs / 36 outputs)

INPUTS
Configurable
Digital inputs (positive / negative)
Analogue inputs voltage 0 V to 5 V, 0 V to 10 V, 0 V to 32 V current 4 mA to 20 mA, Ratiometric, Resistive, Frequency, Phase, Fast Counter, Encoder

OUTPUTS
Configurable
2 A / 4 A
Digital Output High-Sided, Low-Sided
PWM, PWMi

INTERFACES
CAN 1.4
CAN Interfaces 2.0 A/B, ISO11898
50 kbits/s... 1 Mbit/s
J1939, CAN Open and Raw CAN

ETHERNET
10 Mbit/s / 100 Mbit/s, Duplex

USB
USB Host 2.0 (12 Mbit/s)

DIMENSIONS
37 mm x 240 mm x 190 mm (H x W x D)
1.46 " x 9.45 " x 7.48 " (H x W x D)

WEIGHT
1.5 kg

STORAGE TEMPERATURE RANGE
-40 ˚C to +85 ˚C
-40 ˚F to +185 ˚F

OPERATING TEMPERATURE RANGE
-40 ˚C to +85 ˚C
-40 ˚F to +185 ˚F
(at full load)

PROTECTION RATING
IP67 (with mating connectors)

MOUNTING
4 x M6 bolts

RELATED MATERIALS

TITLE	PART NO.
M640 Installation Instructions	053-186
M640 Operator Manual	057-244

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055–198/04/20 (7)

Technical Data

DSEM640

Supply		Connector A
Operating voltage	8 V DC to 32 V DC	Pin 4
Unit power supply maximum current consumption (no external loads)	< 300 mA at 24 V	
Unit power supply current consumption after controlled shutdown has occurred due to the ignition being turned off	< 5 mA at 24 V	
Fusing		**Connector A**
Unit power supply external protection fuse rating	3 A	Pin 4
Maximum total current of the device is 32 A. This includes the device current consumption plus the current supplied to the outputs. Each output supply is rated max 16 A. Output supply 1 + Output supply 2 must not exceed 16 A. Output supply 3 + Output supply 4 must not exceed 16 A.	16 A	Pin 1, 8, 16, 23
Program Enable Pin		**Connector A**
Program enable high (program enabled)	> 6 V	Pin 6
Program enable low (program disabled)	< 2 V	When not used must put to GND
Program enable pin pull-down resistance	33 kΩ	
Housing		
Diecast aluminium		
Dimensions		
49 mm x 240 mm x 190 mm (H x W x D) / 1.46 " x 9.45 " x 7.48 " (H x W x D)		
Weight		
1.5 kg		
Temperature		
Operating temperature	-40 ℃ to +85 ℃ / -40 ℉ to +185 ℉	
Storage temperature	-40 ℃ to +85 ℃ / -40 ℉ to +185 ℉	
Protection Rating		
	IP67 (with mating connector)	
Connectors		
Mating Connector A - 23 pin TE connectivity 1-776228-1		
Connector B - 35 pin TE connectivity 1-776231-4		
Connector C - 35 pin TE connectivity 1-776231-1		
M12, D-coded 4 pole socket		
M12, A-coded 5 pole socket		
Digital Inputs		**Connector B/C**
Digital inputs active high/active low		Pin 6, 9, 14, 15, 16, 22, 28, 31
High level voltage threshold for active high	> 6 V	
Low level voltage threshold for active high	< 2 V	
Analogue Voltage Inputs		**Connector B/C**
0 V to 5 V programmable voltage range	0 V to 5 V	Pin 7, 8, 17, 18, 19, 20, 29, 30
0 V to 10 V programmable voltage range	0 V to 10 V	
0 V to 32 V programmable voltage range	0 V to 32 V	
Voltage measurement resolution	12 bits	
Voltage measurement accuracy	±1% FSD	
Voltage measurement input resistance	≥ 30 kΩ	
Voltage measurement sampling rate	1 kHz	
FSD = Full Scale Deflection		

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Analogue Current Inputs		Connector B/C
Current measurement direction	Current sink only	Pin 7, 8, 17, 18, 19, 20, 29, 30
Current measurement ranges	0 mA to 20 mA	
	4 mA to 20 mA	
Current measurement resolution	12 bits	
Current measurement accuracy	±1% FSD	
Current measurement input sink resistance	100 Ω ±1%	
Current measurement sampling rate	1 kHz	
FSD = Full Scale Deflection		
Analogue Resistive Inputs		**Connector B/C**
Resistance measurement range	0 Ω to 3400 Ω	Pin 7, 8, 17, 18, 19, 20, 29, 30
Resistance measurement source voltage	12 V maximum	
Resistance measurement current	1 mA	
Resistance measurement resolution	12 bits	
Resistance measurement accuracy	±1% FSD	
Resistance measurement sampling rate	1 kHz	
FSD = Full Scale Deflection		
Analogue Ratiometric Inputs		**Connector B/C**
Voltage ratiometric measurement voltage range		Pin 7, 8, 17, 18, 19, 20, 29, 30
Voltage ratiometric measurement Vref	Supply / Vref	
Voltage ratiometric measurement	Ratio of input pin to supply voltage	
Voltage ratiometric measurement accuracy	±1% FSD	
FSD = Full Scale Deflection		
Frequency Inputs		**Connector B/C**
Frequency range	5 Hz to 30 kHz	Pin 6, 9, 14, 15, 16, 22, 28, 31
Resolution	100 Hz at maximum frequency	
Accuracy	400 Hz at Maximum frequency	
Maximum space voltage	< 2 V	
Minimum mark voltage	> 6 V	
Phase Inputs		**Connector B/C**
Frequency range	5 Hz to 30 kHz	Pin 6, 9, 14, 15, 16, 22, 28, 31
Resolution	1 degree	
Accuracy	1 degree	
Maximum space voltage	< 2 V	
Minimum mark voltage	> 6 V	
Pulse Counter Inputs		**Connector B/C**
Frequency range	5 Hz to 30 kHz	Pin 6, 9, 14, 15, 16, 22, 28, 31
Resolution	1 count	
Maximum count	2^{24} (15777215)	
Direction	Up / down	

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Encoder Inputs		Connector B/C
Frequency range	5 Hz to 30 kHz	Pin 6, 9, 14, 15, 16, 22, 28, 31
Resolution	1 count	
Maximum count	2^{24} (15777215)	
Direction	Up / down	
Digital Outputs High Side		**Connector B/C**
Switching current	2 A	Pin 1,2,3,5,11,12,13, 23,24,26,32,34,35
	4 A	Pin 2,4,10,12,13,23,25, 27,35
Digital output active high 'ON' state internal voltage drop at rated current	< 2 V	
Digital output active high 'OFF' state leakage current	< 10 mA at 24 V	
Digital Outputs Low Side		**Connector B/C**
Switching current	2 A	Pin 1,12,13,23,24
	4 A	Pin 12,13,25
Digital output active low 'ON' state maximum voltage at rated current	< 2 V	
Digital output active low 'OFF' state leakage current	< 10 mA at 24 V	
PWM/PWMi Outputs		**Connector B/C**
Peak current rating (software will stop output if > rating detected)	5 A	Pin 1, 2, 3, 12, 13, 23, 34, 35
Minimum PWM frequency	20 Hz	
Maximum PWM frequency	250 Hz	
PWM frequency resolution	0.1 Hz steps	
PWM minimum pulse ratio	0 Hz	
PWM maximum pulse ratio	100%	
PWM pulse resolution	1%	
Current measurement resolution (0 A to 2 A range)	1 mA	
Current measurement resolution (0 A to 4 A range)	2 mA	
Current measurement accuracy	±1% FSD	
Min. load impedance (12 V supply voltage to 4 A output)	3 Ω	
Min. load impedance (24 V supply voltage to 4 A output)	6 Ω	
Reference Voltage		**Connector A**
Reference voltage output	Programmable 5 V or 10 V, 500 mA accuracy ±5%	2
		VRef GND on B21/C21
CAN Interfaces		**Connector A**
Number of CAN interfaces	4	Pin 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22
Supported protocols	J1939	
	CAN open	
	Raw CAN	
Supported programmable baud rates	50 kbit/s, 125 kbit/s, 250 kbit/s, 500 Kbit/s, 800 Kbit/s, 1 Mbit/s	

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Ethernet Interface		M12, 4 pole
Number of Ethernet ports	1	D-coded 4 pole socket
Supported data rates	10 Mbit/s / 100 Mbit/s, duplex	
Supported protocols	MODBUS TCP	
	CODESYS 3.5	

USB Interface		M12, 5 pole
Number of USB host ports	1	B-coded, 5 pole socket
Supported USB version	2	
Speeds supported	Full speed (12 Mbit/s)	
Device class supported	08 (Mass Storage)	
Supported filing system	FAT32	

Processor		
Ti Hercules™ RM microcontroller	32 bit ARM cortex - R4FCPU	
	220 MHz	

Memory		
Internal flash	3 MB	
External flash	8 MB	
Internal RAM	256 kB	
External RAM	8 MB	
FRAM	512 kB	

LED Status

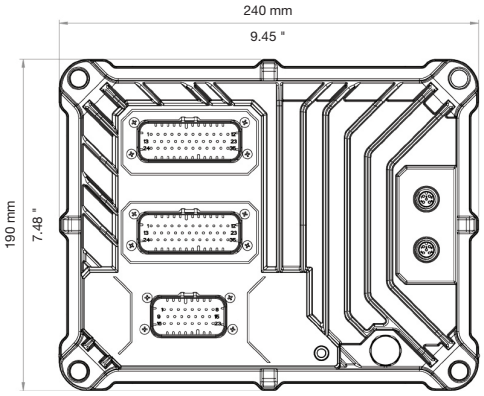
Colour	Description	Operation	State
None	Device not powered	N/A	Off
Green	Unit powered up, application program loaded but not running	Static	Application stopped
	Unit powered up, application program loaded and running	1 Hz flash	Application running
	Unit powered up, but no application program loaded	5 Hz flash	No application
Amber	Bootloader functioning normally, firmware present	Static	Bootloader mode
	Firmware is at start-up	Static	Firmware start-up
	Unit stopped due to a serious fault	Static	Application exception
	Bootloader is decrypting the downloaded image	1 Hz flash	Decrypting image
	Bootloader is reading an image from the USB	5 Hz flash	Reading image from USB
Red	Fatal system/hardware fault - LED may be driven directly by microcontroller error pin or firmware is in a fault condition	Static	Fatal error
	Unit running with a fault, see CODESYS error flags or web tool.	1 Hz flash	Faulty application running

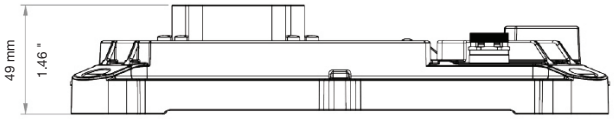
Environmental and Testing		
CE marking	Electromagnetic compatibility (EMC) noise immunity Electromagnetic compatibility (EMC) emission standard Safety of information technology equipment, general requirements	EN 61000-6-2 EN 61000-6-4 BS EN 60950-1: 2006 + A2: 2013
E11	EMC requirements for vehicles Noise immunity with 100 V/m	UN/ECE-R10.05 ISO 11452-2
Electrical tests	Pulse 1, severity level: III; function state C Pulse 2a, severity level: III; function state A Pulse 2b, severity level: III; function state C Pulse 3a, severity level: III; function state A Pulse 3b, severity level: III; function state A Pulse 4, severity level: III; function state A Pulse 5a, severity level: III; function state C	ISO 7637-2 (2004)
Climatic tests	Damp heat, cyclic upper temperature 55 ˚C Damp heat, steady state test temperature 40 ˚C / 93% RH Test duration: 21 days Salt spray test severity level 3 (vehicle)	EN 60068-2-30 EN 60068-2-78 EN 60068-2-52
Mechanical tests	Test VII; vibration, random mounting location: vehicle body. Vibration, sinusoidal 10...500 Hz; 0.73 mm / 10 g: 10 cycles / axis. bumps 30 g / 6 ms; 24,000 shocks	ISO 16750-3 EN 60068-2-6 ISO 16750-3

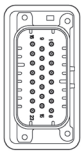
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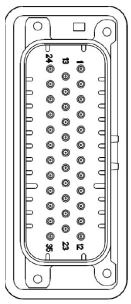






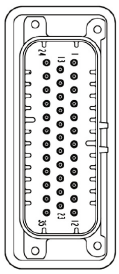
Connector A

PIN	DESCRIPTION
1	Output Supply 1 +VE
2	Vref +VE
3	Ignition +VE (15)
4	ECU Supply +VE
5	ECU Supply GND
6	PRG Enable
7	Output Supply 1 & 2 GND
8	Output Supply 2 +VE
9	Output Supply 3 & 4 GND
10	CAN1 H
11	CAN1 H
12	CAN1 L
13	CAN1 L
14	CAN4 H
15	CAN 4 L
16	Output Supply 3 +VE
17	CAN2 H
18	CAN2 H
19	CAN2 L
20	CAN2 L
21	CAN3 H
22	CAN3 L
23	Output Supply 4 +VE



Connector B

PIN	DESCRIPTION	REF
1	OUT H, L, PWM (2 A)	QB005
2	OUT H, PWM (2 A or 4 A)	QB001
3	OUT H, PWM (2 A)	QB007
4	OUT H (4 A)	QB010
5	OUT H (2 A)	QB014
6	DIN, H, L, FREQ	IB009
7	AIN	IB001
8	AIN	IB002
9	DIN, H, L, FREQ	IB014
10	OUT H (4 A)	QB011
11	OUT H (2 A)	QB015
12	OUT H, L, PWM (2 A or 4 A)	QB004
13	OUT H, L, PWM (2 A or 4 A)	QB003
14	DIN, H, L, FREQ	IB010
15	DIN, H, L, FREQ	IB011
16	DIN H, L, FREQ	IB012
17	AIN	IB003
18	AIN	IB004
19	AIN	IB005
20	AIN	IB006
21	VREF GND	-
22	DIN, H, L, FREQ	IB015
23	OUT H, L, PWM (2 A)	QB006
24	OUT H, L (2 A)	QB018
25	OUT H, L (4 A)	QB017
26	OUT H (2 A)	QB013
27	OUT H (4 A)	QB009
28	DIN, H, L, FREQ	IB013
29	AIN	IB007
30	AIN	IB008
31	DIN, H, L, FREQ	IB016
32	OUT H (2 A)	QB016
33	OUT H (4 A)	QB012
34	OUT H, PWM (2 A)	QB008
35	OUT H, PWM (2 A or 4 A)	QB002



Connector C

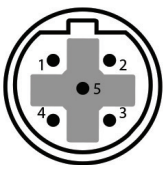
PIN	DESCRIPTION	REF
1	OUT H, L, PWM (2 A)	QC005
2	OUT H, PWM (2 A or 4 A)	QC001
3	OUT H,PWM (2 A)	QC007
4	OUT H (4 A)	QC010
5	OUT H (2 A)	QC014
6	DIN, H, L, FREQ	IC009
7	AIN	IC001
8	AIN	IC002
9	DIN, H, L, FREQ	IC014
10	OUT H (4 A)	QC011
11	OUT H (2 A)	QC015
12	OUT H, L, PWM (2 A or 4 A)	QC004
13	OUT H, L, PWM (2 A or 4 A)	QC003
14	DIN, H, L, FREQ	IC010
15	DIN, H, L, FREQ	IC011
16	DIN H, L, FREQ	IC012
17	AIN	IC003
18	AIN	IC004
19	AIN	IC005
20	AIN	IC006
21	VREF GND	-
22	DIN, H, L, FREQ	IC015
23	OUT H, L, PWM (2 A)	QC006
24	OUT H, L (2 A)	QC018
25	OUT H, L (4 A)	QC017
26	OUT H (2 A)	QC013
27	OUT H (4 A)	QC009
28	DIN, H, L, FREQ	IC013
29	AIN	IC007
30	AIN	IC008
31	DIN, H, L, FREQ	IC016
32	OUT H (2 A)	QC016
33	OUT H (4 A)	QC012
34	OUT H, PWM (2 A)	QC008
35	OUT H, PWM (2 A or 4 A)	QC002



Ethernet

M12 'D' coded - 4 Pin Female

Pin - 01	TX +
Pin - 02	RX +
Pin - 03	TX -
Pin - 04	RX -



USB Host

M12 'B' coded - 5 Pin Female

Pin - 01	+5 V DC
Pin - 02	Data -
Pin - 03	Data +
Pin - 04	ID
Pin - 05	GND

Abbreviations

OUT PWM, H, L	Output can be configured as a PWM, PWMi, digital high-side or digital low-side.
OUT H	Output is digital high.
OUT H, L	Output can be configured as a digital high-side or digital low side.
AIN	Input can be configured to accept signals from positive digital, negative digital, 0 V to 5 V, 0 V to 10 V, 0 V to 32 V, 4 mA to 20 mA, ratiometric or resistive.
DIN, H, L, FREQ	Input can be configured to accept signals from positive digital, negative digital or frequency.

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